SHORT RESUME/ SYNOPSIS OF Ph.D. TOPIC

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"STUDIES ON GROWTH AND DEVELOPMENT OF *CATLA CATLA* (HAMILTON, 1822) FROM NANDED IN RESPONSE TO FORMULATED FISH FEED"

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Brief resume:

Global aquaculture food production continues to rise yearly. It broke a 2018 food production of 82.1 million tonnes record and Asian countries are top food producers. Aquaculture is one of the fastest growing marine fisheries in India, growing at 7% per year. India is the top annual freshwater aquaculture product producer (5.77 million ton), and freshwater aquaculture (over 95% of total production) is the major aquaculture producer, Andhra Pradesh and West Bengal are top aquaculture producing states in fish farming. Fish production is expected to grow by 15 million metric tons in 2020, of which almost 9 million metric tons are expected to be exported from the freshwater aquaculture industry.

In India, fisheries and aquaculture, the two main food producers in the food chain of the country, provide also the main food and revenue benefits to the whole country, yielding significant land and income benefits to the country's food basket. Due to this, emerging industry can provide live hood, employment, business, and livelihood activities to more than 2.8 crores of primary level fishers and fish farmers. It is the world's third largest fishing economy (fish yield-based, inland) based on fish yield 162.48 lakh tons (2021-22) that corresponds to 8% of the world's fish yield. It occupies the second rank in aquaculture production. Fish and fish products at present constitute a category leading position in the Indian market and Indian rupee (IR) marine export revenues are beaten at six-times-high level (Indian rupee 63,969 crore) mark in 2022-23.

Fish provides significant amounts of protein and bioactive amino acids. It is a foodstuff rich in calcium and vitamin A, vitamin B12, and Omega-3 fatty acids. Aquaculture also plays an important role not only in food security of human use, but also in the creation of tons of thousands of employment and income opportunities, significantly, in socially and economically disadvantaged rural societies. FAO (2016) reported the fact that 60 million people are in idling directly (part-time or full-time) taking part in the fish production by fishing or aquaculture, hence being responsible for the live hood (10- 12% around the world population. Aquaculture is currently meeting nearly 50% of the global demand of fish consumers (Subasinghe et al., 2009).

Commercialization of prepared fish feeds is of paramount significance to ecologically sound fish culture. Fish feeding is the most expensive phase in all intensive and semi intensive production systems worldwide. Protein is the major constituent of formulated feeds. Among the other farmed fish species, cultivable fishes are more sensitive to the quality (i.e., amino acid composition) and the amount of proteins provided in the diet as this is for other farmed animal products compared to the others. Ideally protein enrichment in the feed formulation is one of the principal aims of aquatic feeds. According to the scientific literature, it is considered that the best results in relation to the growth of fishes and feeding rates are obtained due to a protein based, preferably of animal origin, such as fish meal (stimulatory activity of high nutritive value) (Dabrowska and Wojno, 1977). However, owing to its high cost and limited availability, substitute for fishmeal is required (Tacon and Jackson, 1985; Webster et al. 1992). Attempts to substitute the fish component of "field" fish feeds have so far not been successful, invariably resulting in suboptimal feed use and rearing performance. Production of high protein value feeds is of one of the main objectives of fish nutrition research.

Introduction:

Aquaculture is an evolving business already supplying the consumer with affordable, quality, nutritious protein. Actually and in the future, the impact all aquaculture systems make on the environment, is today and will be tomorrow, a major topic at the top of the agenda with the environmental implications of feed for fish. There remains the need for an improved understood of the dietary nutritional requirements of commercially bred fish species and it continues to be a striving to obtain cost effective, viable protein sources in place of fishmeal. This strategy, along with the use of the best protein principle into fish feeds and their formulations, can contribute substantially both to the level of pollution, polluting fish production systems and to reduce the cost of production of fish protein.

Deep to skull base, the body of *Catla catla* is flattened, deep and shallowly longitudinally relative to the plane of compression. The wall thickness of the thickest head above is greater than 1/2 the head length. Eyes are big and placed outwards so as to be seen from the bottom of the skull, the nose is extremely well pointed. Jaw base projection is also annotated, as is the mouth widely open and tipped ventrally. The lower lip is fleshy, and the upper lip is congenitally hypoplastic. There are 40-43 lateral line scales. Dusky fins are affixed to the grey body and flanks to the silvery-white, ventrally exposed, underbelly surface of the abdomen.

Catla catla is known to be a fast growing and a highly adaptable species across a large range of freshwater ecosystems, thus is considered a top candidate species for aquaculture. From a research point of view, it has been established that an improved nutritional value in the feed has a direct contribution into a greater performance, FCR and health status of this species of fish (Mishra et al., 2020). Standardized dietary allowance of *Catla catla* for fish feed processing has a major, consequently higher growth rate and hence increased fish feed yield.

Balanced nutrition and feeding are of last consideration in these requirements when fish are cultured in vitro. Fish died and no longer contribute to any useful intake food supply, so growth is null and death can now be reached. Fish with nutritional deficiency may not perform optimally even when fish habitat is floating. There is a very thin boundary line between reduced growth rate and disease process, therefore low cost fish feed with natural antibiotic in advance would continue in essential form of fish culture in captivity.

It's very desirable to understand the nutrient needs of the species in order to be able to produce a pellet with adequate chemical and physical properties at a low cost. Optimal nutrition is a key to success and sustainability of the aquaculture sector in economic, fish health, and high quality product production; while minimizing environmental degradation. Proteins are fish skeleton, therefore they are the main dietary supply from which a certain portion has to be ingested in order to achieve the maximum growth. It is the most costly macromolecule in the fish diet (Pillay, 1990). Thus, the amount of dietary protein that has to be included in the diet should not exceed the amount needed for the maximum possible growth of the fish, i.e. the protein residues of which the fish diets must be able to account for and the cost of which must be incorporated. Decrease in feeding costs will play an important role in the success in aquaculture.

In order that maximum possible production of fish can be attained from freshwater resources, artificial provisioning of feeding that maximizes the growth rate of fish and leads to their greatest commercial weight at the earliest possible time is needed. As an example, fish meal is one of the most commonly incorporated dietary ingredients, and on a general level, fish as a component is a suitable ingredient added to meet the animal protein requirements of fish feed (Alam, et al., 1996). Nevertheless, the use of animal proteins as supplements in fish feeds is unavoidable because the fish feed costs are coupled with availability constraints and, therefore, as animal proteins are cheaper than plant protein supplements, the animals' protein is likely to become a major part of the fish feed in the near future.

It is also favored to feed high carbohydrate content in the composition of diet and therefore this effect is a protein effect and accordingly, the cost of the diet is decreased (Hidalgo et al.,

1993). According to Rumsey (1993), improving the amount of animal protein supplementation in the diet is more economical since of this. Feeds for fish require 60% of the total operating expenses in fish culture (Lovell, 1981, NRC,1983; Niamat and Jafri, 1984; Akiyama, 1988). The issue has been one of the main concerns of business growth and development in aquaculture.

Purpose of carrying out proposed research work:

This study aims to create a fish feed that is accessible and affordable for local fishermen, allowing them to prepare it themselves. By utilizing locally available resources, this research will benefit small-scale fishing operations by providing a low-cost alternative to commercial or supplemented fish feed. This approach will help support the financial stability of local fishermen.

Emphasizing the need for nutrient-enriched feed, this study focuses on using readily available protein sources combined with natural antibiotics. The research also assesses the growth rate and development of *Catla catla*, along with their hematological indices and biochemical composition.

Survey or Review of Literature and Development in the Subject:

A review of literature given as under indicates that the study which is planned through the selected method in Nanded district. Food and Agriculture Organisation (FAO), The United Nation Development Programme (UNDP) both documented feed preparation. In field/lab/artificial systems, it may even be feasible to supply the complete nutrition to a commercially sized aquatic organism (Lieu-I Chiu et al, 1993).

Sahoo et al. (2014) also studied the use of nutritionally complete fish diets for growth performance in the Indian major carps (including *Catla catla*) and concluded that nutritionally complete fish diets could increase the growth of fishes and decrease mortality. On the other hand, they also stressed that feeding excessive diet will have the potential to deteriorate the water quality and also the necessity of creating a suitable relationship between the amount of feed and the water quality control.

In addition, Das and Nayak (2019) are suggesting the incorporation of indigenous inputs in the form of ingredients that are being consumed for feeding. Their study demonstrates that not only are indigenous materials able to reduce feeding costs, but they also can be used to maintain the nutritive value of the food. This approach benefits the sub-beneficiary community of the

small-scale farmer and, as such, it stays on the top of the sustainability and productivity enhancements of aquaculture from an economic point of view.

Patel et al. (2019) analyzed the responses to formulated feed for growth indices of Catla fish under Indian aquaculture conditions. Their work demonstrated that high quality protein-based, good quality diets significantly increased the growth rate, feed conversion ratio (FCR), and condition of fish in comparison to most traditional feeding approaches.

Singh et al. (2021) investigated the impacts of different fish feeds on water quality in catfish rearing. They arrived at the conclusion that, while commercial feeds facilitated fish growth, suboptimal feed management practices could cause an increase in the organic discharge in the water, which had subsequently adverse effects on the water quality. Their study also highlighted the importance of good feed management for protection of water quality deterioration.

Mishra et al. (2020) reviewed use of haematological indices for the diagnosis of fish disease in aquaculture. In addition, they further stated that changes of these adjustable parameters were statistically correlated with malnutrition, epidemic, and atmospheric pollutions. Fish on optimal feed and controlled water values displayed statistically significant stable haematological values, which served the purposes of monitoring the health status of the fish and of highest fish farming quality procedures.

Artificial diet has been established in Japan by Kanazawa (1984) who produced micro particulate diet as an alternative to live foods. The action of feed stimulant on biochemical makeup and growth of the aquatic animal is of a prime interest (Jasmine et a1, 1993).

The final feed, given to the ventral extremity of the aquaculture animal's body, then comes under the action of hydro-bio-geo-metrological type values. The nutritional content of diet is a result of both the rheological and chemical properties of the raw material, as well as the formulation, food processing, feeding storage conditions, and other factors. Quality, palatability and digestibility are the most important criteria that has to be taken into account. Size and rigidity of the feed is one of the physical constraints that should be taken into account in the formulation of the feed. (Alga Swami, 1991).

Importance of the study:

The fish feed developed in this study is affordable and accessible. Fishermen, whether educated or not, can create their own fish food using locally sourced materials without the need for expensive machinery and providing them with financial support.

This approach to aquaculture offers valuable insights into producing low-cost, high-quality organic fish feed, which can enhance fish quality, increase weight, and improve overall health and production levels.

International Status:

Fish health and aquaculture management is a global issue associated with the increasing demand for fish products. Sustainable aquaculture procedures are critical for preserving biodiversity and ecological equilibrium globally.

Standardization of feeding practices for *Catla catla* in various aquaculture systems is currently being established through collaborative international efforts. For example, one multi-national project has been set up with the aim to obtain a composite nutrient profile for *Catla catla* on the basis of data from various publications in order to develop a universal parameter for feed composition. Nevertheless, it is necessary to emphasize that this work is necessarily time sensitive, given that it facilitates knowledge transfer and can also be used to mitigate the effect of disruption on the availability of feeds either without or with an improvement of their quality in different parts of the world.

National status:

The Indian government has also taken a number of steps to promote aquaculture at a national scale, including training workshops and subsidies for fish breeders. The year 2019 National Fisheries Policy stresses the importance of aquaculture to achieving food security and improving the standard of living, particularly in rural areas. Institutions for example Indian Council of Agricultural Research (ICAR) and its collaborating research stations have played a significant role in the development of research to enhance the performance of fish growth by designing the best feed formulations.

Regional Status:

The present study summarizes some of the mechanisms with which the feeding of Indian Major Carp *Catla catla* may be managed more rationally by fish farmers during feeding stage. These cheap, good and nutritive, agricultural wastes, rice bran, peanut cake and soybean meal are utilised well enough by farmers. Not only in terms of dietary quality, the use of food components of local origin in the diet is highly desirable, but it is also favored in a local economic point of view because it is more robust to the negative impacts of the global supply chains.

Scope of the study:

An adequate knowledge of fish feeding behavior is of crucial importance to all scientific disciplines in fishery that study any fish behavior such as feeding as this is the most important biological activity in an animal's life.

Oronsaye Nakpodia (2005) noted that studies of the feeding ecology of habitat freshwater fishes is an on-going area of research because it is the fundamental discipline involved in the development and implementation of an effective fisheries management programme. Highly relevant information about fish diet and feeding ecology is key for the establishment of efficient fish culture.

This research enhances the economic value of *Catla catla* fish through their diet, while also boosting their biochemical composition, which offers significant benefits for human health.

Objectives of the proposed research work:

Objectives of the proposed research work:

1. The selection and use of low cost and eco-friendly materials in the formulation of fish feeds for the culture of edible fresh water fish *Catla catla*.
2. Formulation of different types of selected fish feeds using plant wastes (vegetable and fruit wastes), animal wastes, medicinal herbs and veterinary growth promoters.
3. Effects of the selected diet on growth parameters of fish *Catla catla.*
4. To examine biochemical composition (Protein, Carbohydrate and fat) from the tissues of the fish *Catla catla.*
5. To determine haematological parameters of fish *Catla catla* to assess their health status.
6. To analyse the impact of formulated fish feed on the growth performance, and nutritional properties of fish *Catla catla.*

Hypothesis:

The hypothesis of the present study work is that variation within dietary of the fish feed plays a major role in the growth performance and nutrient utilization of fish *Catla catla*. In this context, it is further argued that the levels of proteins, fat and carbohydrates in the dietary blend will elevated the growth indices, and health of the fish.

ResearchMethodology:

- The freshwater fish *Catla catla* fish will be collected from the Nanded (M.S.) from local fisherman. The fishes were brought to the laboratory and kept in aquarium for experiments.
- Formulation of different types of fish feeds.

- Experimental groups of fish will be fed with formulated fish feed, and growth performance will be monitored over time.
- Standard experimental protocols will be employed for nutritional analysis of fish, growth parameters, Haematological and Biochemical studies.

Limitations of the work:

- Fluctuations caused by environmental changes, like water, temperature or seasonal variations, can affect the health and biodiversity of fish, which makes data interpretation difficult.
- Excess feeding can result in food loss and may also have affect on water quality and productivity inefficiency.
- Adjusting Feeding Frequency Based on Water Temperature Variations.

Expected Outcome:

- To identify and utilize, inexpensive and eco-friendly materials in the fish feed formulation of the edible freshwater fish feed of *Catla catla.*
- A detailed understanding of the biochemical and haematological health of Catla fish, providing benchmarks for aquaculture management.
- Evidence of the effectiveness of formulated fish feeds in improving the growth performance and health of Catla fish.

Year-wise plan of work:

First year: Conduct baseline survey, literature review, Collection of samples.

Second year: Preparation of fish feed. Assessment of growth, biochemical and haematological analysis of *Catla catla* fish.

Third year: Assessment of growth, biochemical and haematological analysis of *Catla catla* fish.

Fourth year: Final data analysis and statistical modelling. Write-up of dissertation and submission of final dissertation.

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